Field Report for Airborne Data Collected In Support of US EPA Region VI Plano Ammonia Release 20 July 2017

Background

On 20 July 2017 the US EPA Region 6 Emergency Operations Center (EOC) requested that ASPECT mobilize to support air monitoring activities for an ammonia release located at the Plano wastewater treatment plant, Plano, Texas (Figure 1). The OSCs (Brandi Todd and Nick Brescia) indicated that a flange/gasket had failed on an ammonia tank at the facility allowing a plume of ammonia to be released from the site.

Due to the close proximity of the aircraft to the site, ASPECT was able to respond to the incident in a under 1 hour from notification with wheels up report at 1728 central time. R6 provided coordinates for the release as 33.030666N 96.528283W.

ASPECT response to this Mission/Incident was in support of:
US EPA Region 6. OSC: Brandi Todd

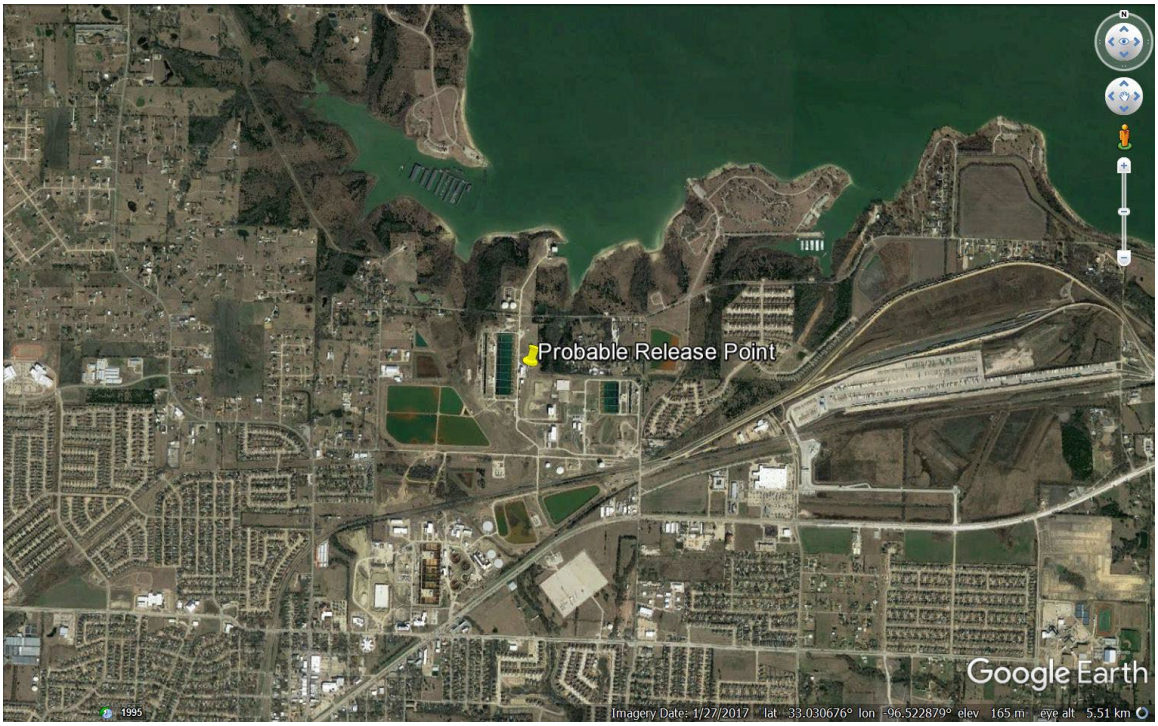

Figure 1. Site Map of the Plano, TX Wastewater Treatment Plant.

ASPECT System

The US EPA ASPECT system was used to collect airborne infrared (IR) images and chemical screening data from a safe distance over the site. The ASPECT System is an emergency response aircraft permitting remote chemical detection in support of the first responder. The system consists of an airborne high speed Fourier transform infrared spectrometer (FTIR) coupled with a wide-area IR line scanner. The ASPECT IR systems have the ability to detect compounds in both the 8 to 12 micron (800 to 1200 cm-1) and 3 to 5 micron (2000 to 3200 cm-1) regions. The 8 to 12 micron region is typically known as the atmospheric window region since the band is reasonably void of water and carbon dioxide influence. Spectrally, this region is used to detect carbon—non- carbon bonded compounds. The 3 to 5 micron region is also free of water and carbon dioxide but typically does not have sufficient energy for use. This band does show use in high-energy environments such as fires. The Carbon – Hydrogen stretch is very common in this region.

Collected data is processed using onboard algorithms while the aircraft is in flight and preliminary data results are sent using a satellite system to the ASPECT reach back team for QA/QC analysis.

Site Conditions and Crew Report

Weather conditions (Plano, TX) at the time of data collection consisted of clear skies with about 10 miles of visibility. Winds were reported from the southeast at 10 Kts. The surface temperature was 39ºC with a humidity of 40%. Flight conditions were reported with mild turbulence characteristic of high temperatures. The crew reported that no visible plume was observed at the facility. Figure 2 shows a visible image of the facility with no observed plume

Figure 2. Visible Image – Plano Wastewater Treatment Facility

Flight Status

The order to launch the aircraft was given at 1830 local on 12 July 2016. The aircraft was airborne at 1928 and was on station about 5 minutes later. Flight information is summarized in Appendix A and Figure 4.

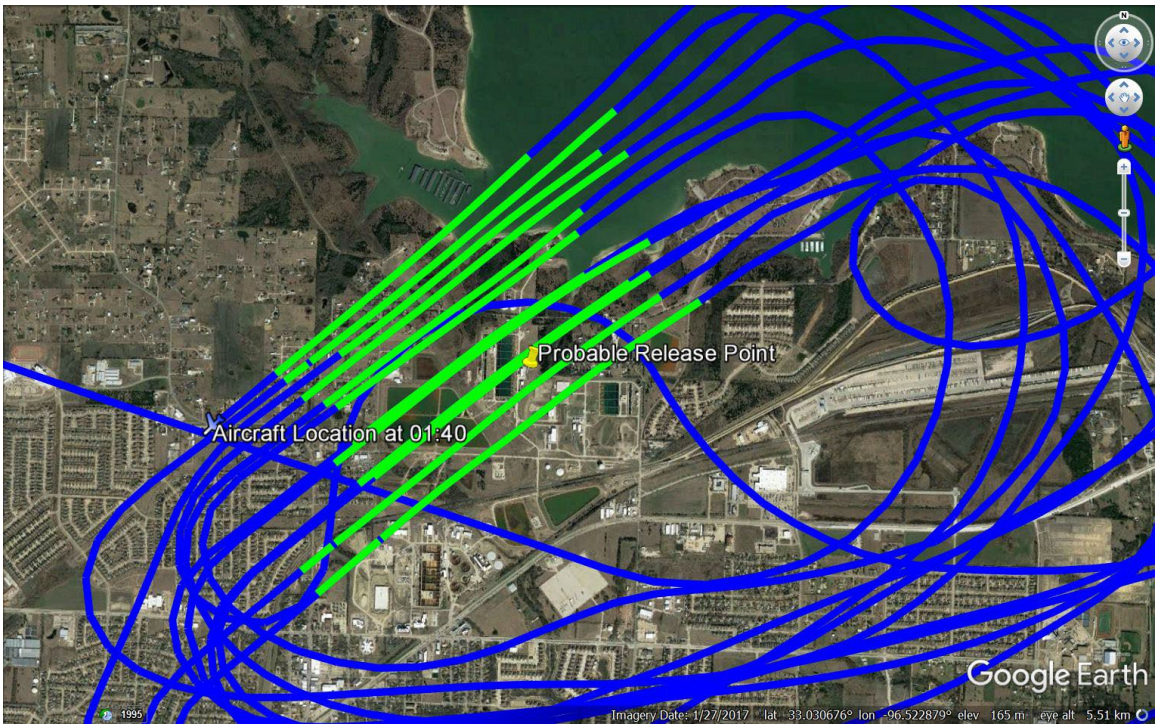

Figure 3. Flight Track, Plano Ammonia Release

Data Results

Line Scanner Data Results

A total of 13 data passes were made and an infrared line scanner image was generated for each pass. Figure 4 shows an IR image generated from Run 2 data using three spectral band pass channels including a channel specific to ammonia. Specific data processing included an alpha residual temperature emissivity separation and a mean noise fraction analysis. A light red plume can be seen being generated on the eastern side of the process building (next to the pond) moving to the northwest across the pond. Subsequent data passes showed the development of a consistent plume.

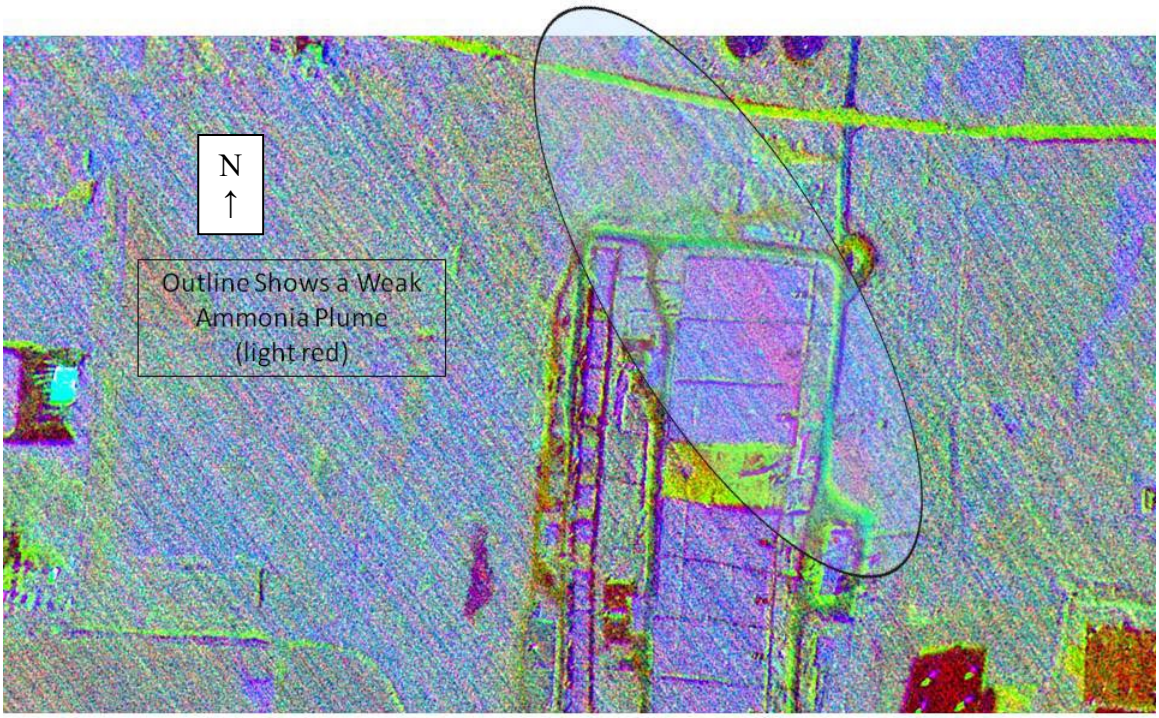

Figure 4, Weak Ammonia Plume, Plano Release Run 4

FTIR Data Results

Spectral data was collected using the FTIR for each pass. A spectral resolution of 16 wavenumbers was used for all data passes. ASPECT uses an automated detection algorithm to permit compounds to be analyzed while the aircraft is in flight. 78 compounds are included in this algorithm and the list and associated detection limits are given in Table 1. In addition, collected data are also manually analyzed by comparing any detected spectral signatures to a collection of published library spectra.

Ammonia was automatically detected on a number of passes with detection locations given in Figure 5. Detection locations are shown as dots on the data pass lines. Only a sub-sample of points are shown due to the scale of the image. An analysis of the concentrations tend to show levels ranging from non detect (approx 1 ppm) to about 10 ppm for data passes near the release. A few points showed levels up to 20 ppm.

The confirmation of ammonia was made by examining collected spectra. Figure 6 shows representative spectra with the characteristic bands of ammonia located at 930 and 960 wave number.

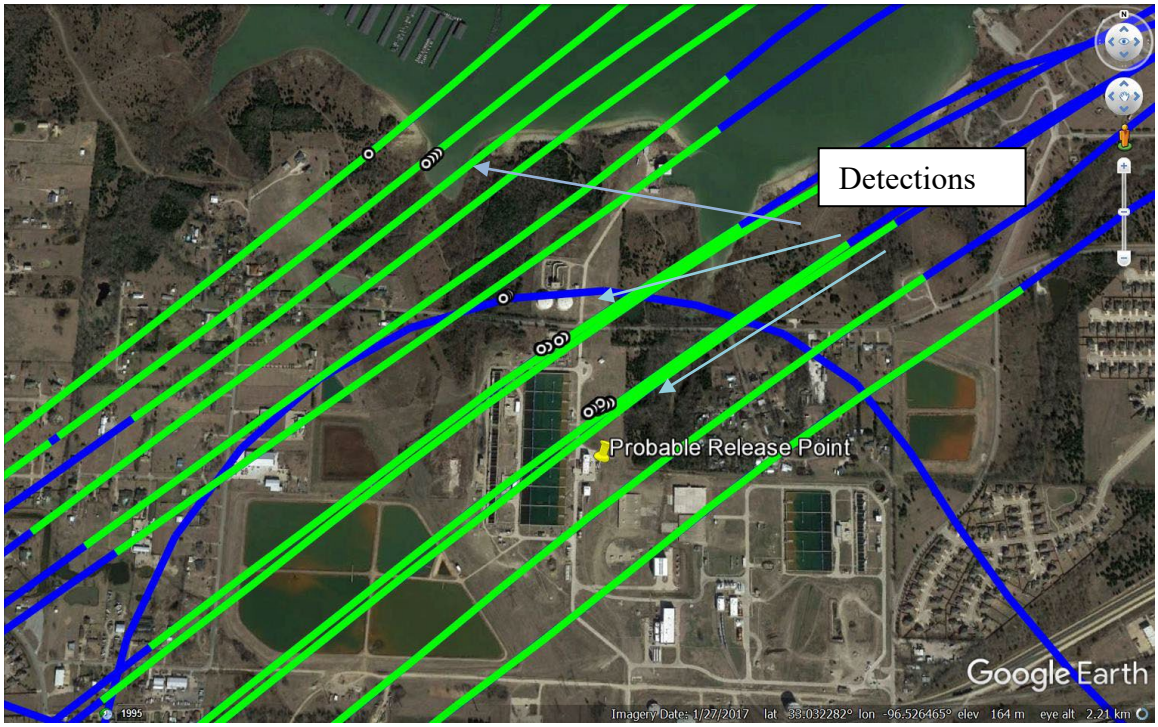

Figure 5 – Ammonia Detection Locations

TABLE 1 - Chemicals Included in the ASPECT Auto-Processing Library

Acetic Acid	Cumene	Isoprene	Propylene
Acetone	Diborane	Isopropanol	Propylene Oxide
Acrolein	1,1-Dichloroethene	Isopropyl Acetate	Silicon Tetrafluoride
Acrylonitrile	Dichloromethane	MAPP	Sulfur Dioxide
Acrylic Acid	Dichlorodifluoromethane	Methyl Acetate	Sulfur Hexafluoride
Allyl Alcohol	Difluoroethane	Methyl Ethyl Ketone	Sulfur Mustard
Ammonia	Difluoromethane	Methanol	Nitrogen Mustard
Arsine	Ethanol	Methylbromide	Phosgene
Bis-Chloroethyl Ether	Ethyl Acetate	Methylene Chloride	Phosphine
Boron Tribromide	Ethyl Formate	Methyl Methacrylate	Tetrachloroethylene
Boron Triflouride	Ethylene	MTEB	1,1,1-Trichloroethane
1,3-Butadiene	Formic Acid	Naphthalene	Trichloroethylene
1-Butene	Freon 134a	n-Butyl Acetate	Trichloromethane
2-Butene	GA (Tabun)	n-Butyl Alcohol	Triethylamine
Carbon Tetrachloride	GB (Sarin)	Nitric Acid	Triethylphosphate
Carbonyl Chloride	Germane	Nitrogen Trifluoride	Trimethylamine
Carbon Tetraflouride	Hexafluoroacetone	Phosphorus Oxychloride	Trimethyl Phosphite
Chlorodifluoromethane	Isobutylene	Propyl Acetate	Vinyl Acetate

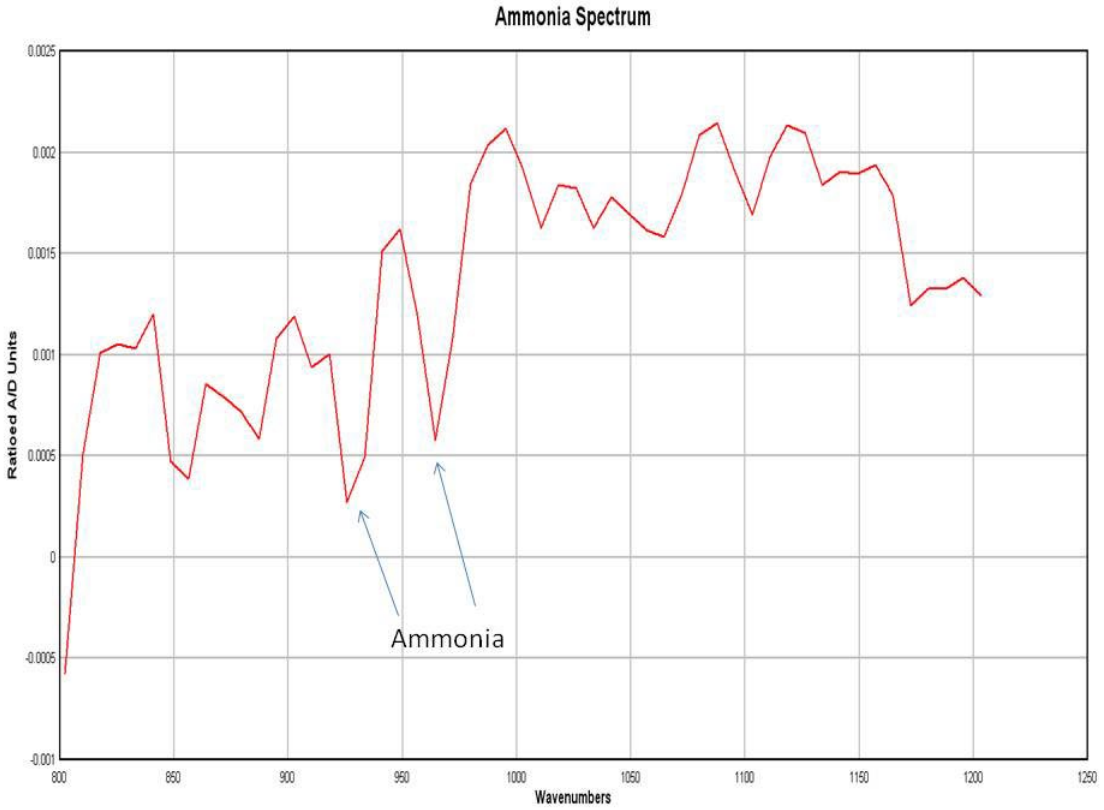

Figure 6 – Ammonia Confirmation Spectra

Conclusions

ASPECT was dispatched to support response efforts associated with the Plano wastewater treatment plant ammonia release which occurred on 20 July 2017. A total of 13 data passes were collected with most showing measureable concentrations of ammonia being released from the facility and moving toward the northwest. Concentrations of ammonia were estimated to be approximately 10 ppm for those data passes nearest the release. A defined plume was observed in the IR imagery and also noticed on the pattern of detections using the ftir.

Appendix A. Flight Summary Log

Mission: 2017-07-21 Plano Emergency Response

Date: 7/21/2017
Time UTC: 00:31

IRLS: TA= 29.0 TB = 49.0 Gain = 3

Aircraft Number: N9738B
Pilot: Beorn Ledger
Copilot: Beorn Ledger
Operator: Bob Kirby
Aft Operator: Bob Kirby
Ground Controller: 2016-04-11 201

DEM: Using elevation from DEM Database

Run: 1 Time: 00:44:54 UTC
Alt: 2535 ft MSL Elev: 593 ft Elevation from DEM Database
Vel: 147 knots Heading: 114

Digitals: 4
24mm2017_07_21_00_44_32.jpg
24mm2017_07_21_00_44_38.jpg
24mm2017_07_21_00_44_45.jpg
24mm2017_07_21_00_44_51.jpg
MSIC: 4
20170721004506530.jpg
20170721004512885.jpg
20170721004519239.jpg
20170721004525593.jpg
FTIR: 1
20170721_004502_A.igm
IRLS: None
Gamma Runs: None

Run: 2 Time: 00:48:36 UTC
Alt: 3340 ft MSL Elev: 522 ft Elevation from DEM Database
Vel: 121 knots Heading: 226

Digitals: 5
24mm2017_07_21_00_48_14.jpg
24mm2017_07_21_00_48_20.jpg
24mm2017_07_21_00_48_27.jpg
24mm2017_07_21_00_48_33.jpg
24mm2017_07_21_00_48_39.jpg
MSIC: 5
20170721004848024.jpg
20170721004854378.jpg
20170721004900733.jpg
20170721004907088.jpg
20170721004913442.jpg
FTIR: 1
20170721_004839_A.igm
IRLS: None
Gamma Runs: None

Run: 3 Time: 00:53:37 UTC
Alt: 3309 ft MSL Elev: 522 ft Elevation from DEM Database
Vel: 107 knots Heading: 227

Digitals: 5
24mm2017_07_21_00_53_15.jpg
24mm2017_07_21_00_53_22.jpg
24mm2017_07_21_00_53_28.jpg
24mm2017_07_21_00_53_34.jpg
24mm2017_07_21_00_53_40.jpg
MSIC: 5
20170721005349417.jpg
20170721005355770.jpg
20170721005402130.jpg
20170721005408480.jpg
20170721005414835.jpg
FTIR: 1
20170721_005341_A.igm
IRLS: None
Gamma Runs: None

Run: 4 Time: 00:57:34 UTC
Alt: 3322 ft MSL Elev: 525 ft Elevation from DEM Database
Vel: 113 knots Heading: 226

Digitals: 6
24mm2017_07_21_00_57_12.jpg
24mm2017_07_21_00_57_18.jpg
24mm2017_07_21_00_57_25.jpg
24mm2017_07_21_00_57_31.jpg
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24mm2017_07_21_00_57_43.jpg
MSIC: 6
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20170721005759075.jpg
20170721005805431.jpg
20170721005811786.jpg
20170721005817232.jpg
FTIR: 1
20170721_005738_A.igm
IRLS: None
Gamma Runs: None

Run: 5 Time: 01:01:25 UTC
Alt: 3403 ft MSL Elev: 530 ft Elevation from DEM Database
Vel: 112 knots Heading: 224

Digitals: 7
24mm2017_07_21_01_01_03.jpg
24mm2017_07_21_01_01_10.jpg
24mm2017_07_21_01_01_16.jpg
24mm2017_07_21_01_01_22.jpg
24mm2017_07_21_01_01_29.jpg
24mm2017_07_21_01_01_35.jpg
24mm2017_07_21_01_01_41.jpg
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20170721010144223.jpg
20170721010150578.jpg
20170721010156933.jpg
20170721010203288.jpg
20170721010208734.jpg
20170721010215090.jpg
FTIR: 2
20170721_010129_A.igm
20170721_010208_A.igm
IRLS: None
Gamma Runs: None

Run: 6 Time: 01:06:26 UTC
Alt: 3273 ft MSL Elev: 532 ft Elevation from DEM Database
Vel: 106 knots Heading: 224

Digitals: 8
24mm2017_07_21_01_06_04.jpg
24mm2017_07_21_01_06_11.jpg
24mm2017_07_21_01_06_17.jpg
24mm2017_07_21_01_06_23.jpg
24mm2017_07_21_01_06_29.jpg
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FTIR: 2
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20170721_010709_A.igm
IRLS: None
Gamma Runs: None

Run: 7 Time: 01:11:20 UTC
Alt: 3234 ft MSL Elev: 521 ft Elevation from DEM Database
Vel: 104 knots Heading: 227

Digitals: 7
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24mm2017_07_21_01_11_04.jpg
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24mm2017_07_21_01_11_17.jpg
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20170721011145223.jpg
20170721011151577.jpg
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20170721011203379.jpg
20170721011209734.jpg
FTIR: 1
20170721_011124_A.igm
IRLS: None
Gamma Runs: None

Run: 8 Time: 01:16:09 UTC
Alt: 3243 ft MSL Elev: 523 ft Elevation from DEM Database
Vel: 108 knots Heading: 227

Digitals: 6
24mm2017_07_21_01_15_47.jpg
24mm2017_07_21_01_15_54.jpg
24mm2017_07_21_01_16_00.jpg
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20170721011652986.jpg
FTIR: 1
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IRLS: None
Gamma Runs: None

Run: 9 Time: 01:20:33 UTC
Alt: 3313 ft MSL Elev: 520 ft Elevation from DEM Database
Vel: 104 knots Heading: 227

Digitals: 6
24mm2017_07_21_01_20_12.jpg
24mm2017_07_21_01_20_18.jpg
24mm2017_07_21_01_20_24.jpg
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FTIR: 1
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IRLS: None
Gamma Runs: None

Run: 10 Time: 01:24:57 UTC
Alt: 3349 ft MSL Elev: 512 ft Elevation from DEM Database
Vel: 110 knots Heading: 226

Digitals: 7
24mm2017_07_21_01_24_35.jpg
24mm2017_07_21_01_24_41.jpg
24mm2017_07_21_01_24_48.jpg
24mm2017_07_21_01_24_54.jpg
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20170721012534093.jpg
20170721012540450.jpg
20170721012546804.jpg
FTIR: 1
20170721_012500_A.igm
IRLS: None
Gamma Runs: None

Run: 11 Time: 01:30:17 UTC
Alt: 3382 ft MSL Elev: 501 ft Elevation from DEM Database
Vel: 98 knots Heading: 226

Digitals: 6
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20170721013055474.jpg
20170721013100922.jpg
FTIR: 1
20170721_013022_A.igm
IRLS: None
Gamma Runs: None

Run: 12 Time: 01:34:46 UTC
Alt: 3333 ft MSL Elev: 502 ft Elevation from DEM Database
Vel: 107 knots Heading: 224

Digitals: 7
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IRLS: None
Gamma Runs: None

Run: 13 Time: 01:39:27 UTC
Alt: 3362 ft MSL Elev: 511 ft Elevation from DEM Database
Vel: 109 knots Heading: 224

Digitals: 6
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IRLS: None
Gamma Runs: None

Mission Complete: 02:01 (UTC)